ACTA PARASITOLOGICA POLONICA
VOL. VIII WARSZAWA, 1.VI.1960 FASC. 10

Department of Fish Diseases, Agricultural College, Olsztyn
Head: Prof. Dr. Eugeniusz Grabda

Krystyn WIERZBICKI

Philometrosis of crucian carp

Filometroza karasia

The disease is caused by the nematode *Philometra sanguinea* (Rudolphi, 1819), belonging to the suborder *Camallanata* Chitwood, 1936, family *Dracunculidae* Leiper, 1912 (syn.: *Philometridae* Baylis et Daubney, 1926), genus *Philometra* Costa, 1845 (syn.: *Ichtyonema* Diesing, 1861; *Filaria* Müller, 1787; *Sanguinofilaria* Yamaguti, 1941).

Philometra sanguinea (Rud.) was for the first time observed and described in 1819 by Rudolphi under the name *Filaria sanguinea*. Later on it was again described in 1825 by Creplin under the name *Filaria cyprini-rutili* and by Diesing in 1861 as *Ichtyonema sanguineum*.

The development of *Philometra sanguinea* was for the first time described by Strassen in 1906. However, he stated wrongly that the larvae of the nematode attacking shellfish, actively penetrate into the body cavity. The incorrectness of this statement was proved by Nybelin, who traced the development of the parasite in 1931.

In Poland up to the present date there was no accurate description of any of the species belonging to the genus *Philometra* in spite of the fact that they were found several times. Kozicka (1951) found in the course of studies of the parasitofauna of fishes from the middle course of Vistula (shoals n/Warsaw) several individuals of *Abramis brama* (L.) and *Blicca björkna* (L.) invaded with *Philometra opercularis* Nybelin, 1931, and later she found the same nematode in one *Abramis brama* (L.) from the lake Drużno 1959. In the same year also E. Grabda observed in the lower course of Vistula *Philometra opercularis* in *Rutilus ruti-*

lus (materials not published*). Recently Gąsowska (1956) found this nematode in the body cavity of *Abramis brama* (L.) in the water reservoir Otmuchów. The diagnosis proved that it was the species *Philometra ovata* (Zeder, 1803)*. All the nematodes of the genus *Philometra* found by the investigators were mature females. No males were found because accurate searches were not conducted. Notes on the finding of nematodes of this genus in Poland are limited only to the statement of the occurrence of the parasites, but nobody took greater interest in them. In my opinion such scanty reports of the occurrence of the nematodes does not indicate that they occur so seldom, but proves rather that little interest was taken in the nematodes of fishes.

Data cited in the literature state the occurrence of *Philometra sanguinea* in many species of fishes. Hofer (1902), Linstow (1909) and following him Skrjabin (1954) report on the occurrence of this nematode in *Carassius carassius* (L.), *Carassius auratus gibelio* (Bloch), *Rutilus rutilus* (L.), *Abramis brama* (L.), *Blicca björkna* (L.), *Vimba vimba* (L.), *Osmerus eperlanus* Cuv., *Anguilla anguilla* (L.) and *Cottus gobio* (L.). Hitherto I succeeded to find *Ph. sanguinea* only in *Carassius carassius* (L.) in spite of the fact that in the lakes, where I found it, there were also other species of fishes. Owing to the lack in the local ichthyofauna of *Carassius auratus gibelio* (Bloch), on which Nybelin conducted his experiments, I could not find out the possibility of its invasion. My observations referring to the specificity of the parasite corroborate the observations of Čákay (1957) who conducted studies on fishes from the river Vag. Markevič (1951) too does not find invasion with *Ph. sanguinea* in other fishes than in *Carassius carassius* (L.). I think that many data in the literature referring to the occurrence of this nematode in many species of fishes were incorrect, because it was not long time ago when the nematode was not even accurately diagnosed. Most likely the investigators diagnosed as *Philometra sanguinea* also other species belonging to the same genus. There are in the literature determinations which link together such species as *Ph. sanguinea* (Rudolphi, 1819), *Ph. abdominalis* Nybelin, 1928, *Ph. ovata* (Zeder, 1803) and *Ph. opercularis* Nybelin, 1931 (Markevič regards the name of the latter species as synonym of *Ph. rischta* Skrjabin, 1917). To determine

* The nematodes were diagnosed by the author of this paper.

exactly every one of the species into consideration should be taken the habitat of the nematode in the hest, shape of its body, size and development of the cuticle. Nybelin (1931) presents exact data referring to the differentiation of the known to him species of the genus *Philometra*, namely: *Ph. abdominalis* Nybelin, 1928, *Ph. opercularis* Nybelin, 1931, *Ph. ovata* (Zeder, 1803) and *Ph. sanguinea* (Rudolphi, 1819). In the course of my experiments I found *Philometra sanguinea* not only, as reported by Nybelin, between the rays of the caudal and dorsal fins, but also fairly commonly in the anal fin and in one specimen — in the ventral fins. Besides this I found three mature females, 17 — 42 mm in length, in the body cavity of a crucian (the uterus in one of them was completely filled up with mature larvae).

Besides the species taken into consideration in Nybelin's collection there occur in the European fishes two more species of the same genus. The first of them, *Philometra intestinalis* Dogiel et Bychovsky, 1934 is the smallest nematode of this genus, and the second, *Philometra obturans* (Prenant), the biggest.

Occurrence of *Philometra sanguinea* (Rud., 1819) in Poland

Philometra sanguinea was for the first time observed in Poland by J. Grabda in February, 1956 in the caudal fin of *Carassius carassius* from the lake Track (Olsztyn district). The second centre of its occurrence was detected in the Spring 1956 by E. Grabda (lake Skrwilno, Bydgoszcz district). Later on I was informed by Jarosz that *Philometra sanguinea* occurs also in *Carassius carassius* in the lakes Wildno and Ugon, which belong to the same farm, as the lake Skrwilno. In 1957 and 1958 I observed this nematode in *Carassius carassius* from small ponds in Olsztyn district and in the Spring 1959 I found it in *Carassius carassius* caught in the strongly eutrophic bays of the large lakes Niegocin and Jagodno (region Giżycko).

All the reservoirs in which hitherto the *Philometra sanguinea* was found are in the fisherman language lakes of the crucian type of a small surface (the largest of them — 87 ha), whereby in the large lakes (Niegocin and Jagodno) into play come only the eutrophic bays in which the *Carassius carassius* (L.) live. The maximal depth of the reservoirs in which the nematode occurs reaches 5 m.

The lake Track originated by the inundation of meadows. The ichthyofauna of this lake consists of several species with the preponderance of *Carassius carassius* (L.). Besides it there occur: *Cyprinus carpio* L. and *Tinca tinca* (L.), fairly many *Perca fluviatilis* L. and few *Esox lucius* L. The rough fish is composed of *Leucaspius delineatus* (Heckel) and *Gasterosteus aculeatus* (L.). There occur also in this lake very few *Rutilus rutilus* (L.) and *Pungitius pungitius* (L.).

The banks of the lake are gentle and only on a small section they are steep. They are on a small strip covered with *Scirpus* sp., or they are free. At some distance from the bank there are several small islets of *Phragmites communis* Trinius and *Juncus* sp. Every year the water in the lake "blooms" very strongly. Generally taking the reservoir is of the eutrophic type, although it combines certain characteristics of the "natural pond".

The lake Skrwilno is of a completely different type. It is a very old lake, very obstructed with slime and partly dystrophic. Its banks are flat, partly peaty (the north-western bank lies very low, covered with bushes and a broad strip of reeds), and partly sandy (the north-eastern bank is bare). The central part of the lake is occupied by an island covered with trees, and surrounded by a strip of *Phragmites communis* Trinius and *Typha latifolia* L. The whole bottom of the lake is overgrown with soft flora. The maximal depth reaches here 1.7 m. The set of the ichthyofauna consists of *Tinca tinca* (L.) and *Carassius carassius* (L), and in smaller number of *Esox lucius* L. and *Perca fluviatilis* L.

The lake Wildno (up. to 5 m in depth) and the lake Ugon (up to 3 m in depth) are eutrophic lakes with the ichthyofauna in Wildno: *Tinca tinca* (L.), *Esox lucius* L., *Carassius carassius* (L.), *Rutilus rutilus* (L.) and *Perca fluviatilis* L., and in Ugon: *Tinca tinca* (L.), *Carassius carassius* (L.) and *Esox lucius* L.

From observations of the places of the occurrence of the parasite can be drawn the conclusion, corroborated also by data in the literature, that for the development of *Philometra sanguinea* most suitable are very shallow reservoirs, which get during summer strongly warmed and have no hypolimnion.

Description of young forms of *Philometra sanguinea* (Rud. 1819)

The characteristics of the species observed by me are entirely in agreement with Nybelin's (1928, 1931) taxonomic data.

The young females of the nematode are in the period of copulation very small, considerable smaller than the mature forms. Their length fluctuates within the limits 2.1 — 2.7 mm. The males at this time, growing later no more, are 3.1 — 3.3 mm in length. The cuticle of the males and young females, differently than in mature

forms, is smooth. Among the young individuals only the females are provided at the distance of about 2/3 of the anterior part of the body with a single hillock. On it there is located the genital pore (Fig. 1a), which atrophies after copulation. The males are provided on the posterior end of the body with a well developed

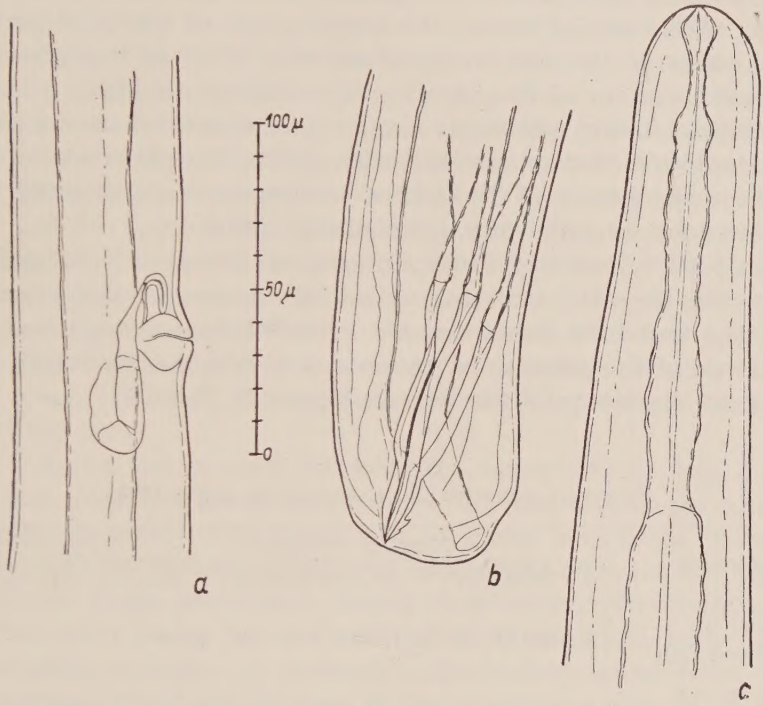


Fig. 1. *Philometra sanguinea.* (R u d.) *a* — Environment of genital pore of young female; *b* — Terminal part of male; c — Front part of young specimen.

copulation apparatus, which consists of two spicula and a additional listel (Fig. 1b). The males and young females have a well developed alimentary tract (Fig. 1c), which in females in the later period atrophies partly — the intestine becomes thinner and the anal pore completely closes.

Laboratory studies

The aim of the present work, started in February 1956, was to repeat the development of *Philometra sanguinea* under laboratory conditions and to trace it parallelly under natural conditions. It was

also aimed to prove the relation between the temperature of the environment and the rate of the development of the parasite.

The material elaborated by me originated mainly from the lake Track and in a small percentage from the lake Skrwilno. I compared the results obtained in the laboratory with the development of the parasite in the lake Track. The collected material was kept in large aquaria with running water, the temperature of which, depending on the season of the year, ranged from 10—16°C. In the laboratory were used aquaria of the capacity from 250 ml to 300 l. To make the artificial living conditions similar to the natural ones I placed on the bottom of the aquaria sand with plants. The plankton required for the development of *Philometra sanguinea* was collected from the reservoirs, in which the nematode did not live.

The total number of 510 specimens of *Carassius carassius* (L.) of the size 35 — 210 mm was examined by me. In the examined material I found 208 fishes invaded with *Philometra sanguinea*. The occurrence of the parasite in its various developmental stages, depending on the season of the year, is shown in Table I.

Table I

Carassius carassius (L.) examined in 1956—1958

Months	Number of fishes												To-tal	Intensity of invasion
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
Number of examined fish	2	48	34	29	59	105	101	21	44	50	6	1	510	
Total No. of invaded	1	32	17	11	28	26	33	5	15	33	4	—	208	
Mature females in fins	1	32	16	8	27	10*	—	—	1	17	3	—	113	1—17
Mature females in body cavity	—	—	1	2	—	—	—	—	—	—	—	—	3	1
Young females in body cavity	—	—	—	—	1	6	9	—	3	2	—	—	22	1—6
No. of invaded with males	—	2	3	3	3	14	19	14	12	24	1	—	95	1—7
With encysted dead males	—	12	4	7	1	—	2	—	—	—	—	—	26	1—2

* Mature females found only in fish from lake Skrwilno, in which a delay of life cycle was observed

The Table shows that under natural conditions the complete developmental cycle of the nematode lasts one year. The females of *Philometra sanguinea* are found in *Carassius carassius* during the whole year, but depending on the season of the year they occur in various developmental stages. The youngest forms are found in the body cavity of the fish during summer months from May till October, whereby in the extreme months of this period they occur very seldom. The form found in May was very young and smaller than the individuals caught later. Young females were found in September and October only when there were no males in the body cavity of the fish. This observations leads to the conjecture that fertilized females leave the body cavity and those not fertilized ramain in the body cavity, but develop no further more and finally die. The females do not occur in the fins of fishes during the summer months and are found not before September. During the further period of autumn and winter their number in the fins increases. From February till May the number of parasites remains on the same level, but later, during June, almost all parasites leave the fins of the hosts.

The males are present in the body cavity of the fish during the whole year and the largest number is found during the summer and autumn period. The sham lack of males (see Table I) during January and December is accidental and results from the too limited number of fishes examined during that period. The number of parasites, both young females and males, found in the body cavity of *Carassius carassius* is certainly considerably lower from their real number. They can be very easily overlooked because of their very small dimensions (length 2.1 — 3.3 mm, and thickness about 0.07 mm).

Wanting to repeat the development of the nematodes under laboratory conditions I invaded some plankton *Crustacea* and 57 specimens of *Carassius carassius* of the length 37 — 150 mm. The outcome of invasion and results are shown in the Table II.

As seen in the Table the fishes were invaded mainly with males which I constantly found also in my further studies. The females were found in the body cavity of the fishes only during the course of three months, because after they hawe been fertilized they teft the body cavity. In one case the young females found in the body cavity of a fish in October were not fertilized owing to the absence of males (similarly to cases I met also in my field studies). Invading

under laboratory conditions and keeping the invaded fishes at the temperature 15 — 22°C, I found after six months in the caudal fins of *Carassius carassius* the females of the nematode with mature, invasive larvae. The fishes in which I found in the fins mature nematodes were over 10 cm in length; all the smaller specimens with positive result of invasion died after several weeks.

Table II

Experiments on artificial invasion of crucians

Months	Number of fishes												Total	Intensity of invasion
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
Invaded crucians	—	—	1	5	18	33	—	—	—	—	—	—	57	
Examined crucians*	—	—	1	2	4	9	7	1	3	1	2	4	34	
Invaded with young females	—	—	—	—	1	3	4	—	—	1	—	—	9	1—5
Invaded with mature females	—	—	—	—	—	—	—	—	—	—	—	3	3	1—2
Invaded with males	—	—	—	2	1	7	3	1	1	—	2	1	18	1—22

* Not all invaded crucians were examined because some of them died in the evening or at night, and owing to high temperature of water in aquarium rapid decomposition of tissues of fish and parasite took place.

The development of *Ph. sanguinea* conducted by me under laboratory conditions proves that this nematode, under suitable climatic conditions (warm winter), can in the course of one year attain two complete developmental cycles.

In the course of conducting the development of the parasite I studied the variability of the size of the body of larva depending on the age. The larvae, which left the uterus, were 0.37 — 0.40 mm in length. After reaching the water and later after invading the intermediate and final hosts the larvae were growing and attained: after 5 days 0.41 — 0.42 mm, after 10 days 0.44 — 0.46 mm, after about 20 days 0.53 — 0.57 mm, after 33 days (one larva) 0.65 mm, after 2 months (one larva) 1.02 mm.

Free living larvae I found only during 9 days following their migration from the maternal body. Next measurements were taken

on larvae found in invaded *Cyclops kolensis* Lill. As the growth of the larva proceeds, the proportion of the size of the whole body to that of the tail (part of the body located behind the anus) changes. Its length constantly decreases and at the moment of the migration of the larvae to water it is 0.070 — 0.075 mm, after 4 days 0.066 — 0.071 mm, and after 6 days 0.063 — 0.067 mm.

After a long sojourn of the larva in the body cavity of *Cyclops kolensis* Lill. (above one month) the tail disappears completely. The same takes place when the parasite reaches the body cavity of the fish. The thickness of the body of the larva increases with age. On the first day, when the larva leaves the maternal body, it ranges from 0.001 — 0.013mm, after 5 days 0.013 — 0.016 mm, and after 10 days 0.015 — 0.017 mm.

Nybelin's (1931) studies on the development of *Ph. sanguinea* proved that the intermediate hosts of this parasite are: *Cyclops strenuus* Fischer, *Leptocyclops agilis* Sars and *Pachycyclops* sp., that means hosts which I found in the small ponds. To verify which species of *Crustacea* under our climatic conditions are indispensable for the development of *Ph. sanguinea* I invaded with the larvae of the nematode *Copepoda* originating from two different reservoirs. My experiments proved that only the rapacious forms of the *Copepoda,* suitably large, able to eat the larvae of the parasite, 0.4 — 0.5 mm in length — became invaded. The species which I was able to invade were *Copepoda* of the genera: *Cyclops* Müller, *Mesocyclops* Sars and *Macrocyclops* Claus. Small rapacious forms of *Copepoda (Microcyclops* sp.), and among them also lower copepods of larger, to which the larvae of the nematode were too large to be eaten, were not invaded.

The larva, after being eaten by *Copepoda,* penetrates the wall of the intestine and reaches the body cavity in which it has no strictly defined place of location (Phot. 1).

Before the description of the development of *Ph. sanguinea* presented by Nybelin (1931) in the literature there were reports describing the way of invasion as an active penetration of the larvae of the parasite into the body cavity of the *Copepoda* through the shells of the body (Strassen). Repeating Nybelin's experiments I placed the crustacean (*Cyclops* sp.) in a drop of water together with mature larvae of the nematode. After several minutes I took it out of water and rinsed it. In the first period we find live larvae only in the intestinal lumen, visible not before the prepa-

ration of the alimentary tract. To repeat the second experiment I placed the crustacean for several minutes in a drop of water together with the larvae of the nematode. After taking it out of water and rinsing, I kept it in a dish in pure water. Initially I saw nothing in its body cavity. After some time (25 — 30 minutes) the larvae started to penetrate to the body cavity punching previously the intestine. I did not manage to succeed to get an invasion with the nematode in not rapacious *Crustacea*, such as *Daphnia* sp., *Bosmina* sp. and *Diaptomus* sp., in spite of preparing large concentrations of the larvae in the dishes in which the experiments were conducted.

Attempts to get an invasion with *Ph. sanguinea* in higher *Crustacea* (*Asellus aquaticus* and *Gammarus pulex*) failed to give positive results.

The invasiveness towards *Crustacea* is exhibited only by invasive larvae, in the period up to five days from the moment of the leaving the uterus of the maternal organism. Immature and older larvae do not invade the intermediate host and even when they are eaten by the host they die and are digested.

In the examined by me lakes of the multispecies ichthyofauna I did not find *Ph. sanguinea* in other species of fishes than in *Carassius carassius*. Therefore I regard this nematode as the parasite specific to this fish, and attempts to invade fishes with the larvae of the nematode were made in crucian.

The experiments proved that the larvae of the nematode become invasive after about four days lasting stay in the body cavity of the crustacean. Nybelin (1931) reports that after 5 days in the larvae there appeared a supraoesophageal gland with an "enormous" nucleus, but I did not succeed to observe it. Nybelin does not associate it with invasiveness. After the period of 8 — 10 days the larva ceases to be dangerous in spite of the fact that it can live in the body of the cyclop up to two months. Attempts to invade fishes with the larvae of the nematode younger than 4 days and with older than 14 days gave negative results.

Not invasive larvae after being eaten are in the alimentary tract of the fish digested together with the intermediate host; the invasive larvae, however, after reaching the intestine of the final host, pierce the wall and migrate under the peritoneum on the borderline of the kidney, swimming bladder and gonads (but do not penetrate into the pulp of the organs). The migration of the

larvae is rapid and already after few days they can be found in the above mentioned place. The smallest larva found by me in the body cavity of a fish measured 0.72 mm in length. It was found after 10 days from the moment of invasion.

In the body cavity, in the region of the swimming bladder, the larvae of the nematode grow and differentiate into males and females. The morphological description of the young parasites was given earlier. After attaining sexual maturity the parasites copulate and next the fertilized females leave the body cavity. Young crucians, smaller than 9 cm, cannot endure the migration and die in the course of about one month from the moment of invasion of the fish. This corresponds to the period of the attainment of sexual maturity of the young nematodes and the migration of the young females from the body cavity of the fish under our climatic conditions (the temperature of water in this period, June, is about 20°C). Having made in the beginning of my work such an assumption I was able to prove it by my experiments conducted in the laboratory and by my observations of the population of *Carassius carassius* from the lake Track. In my attempts to conduct a full development of the nematode under artificial conditions I succeeded only on larger than 10 cm in length fishes, all the smaller invaded fishes died during the migration of the females of the parasite.

After leaving the body cavity the females remain in the body of the fish for a period of several months, depending on the temperature of water. I did not succeed to determine exactly the location of the parasites in the body in spite of numerous and accurate studies conducted in the invaded material. I succeeded to prove that the females of the parasite stay in this period in the body of the fish by keeping in an aquarium the crucians collected from the lake in the spring till autumn. In autumn there appeared in the fins of the fishes the females of the nematode. Conducting studies on the fishes in summer to control the development of the females of the parasite I was not able to find them anywhere. The males were found in the body cavity of the fish during the whole time.

Mature females migrate in autumn, winter, the last of them in spring to the fins of the hosts (Phot. 2 and 3). Trey remain here for some time, depending on the degree of maturity and on the temperature of water; under our natural climatic conditions all of them remain till the spring. In winter, at the low temperature of water,

the development of the nematodes is almost completely inhibited. In the spring, by the end of May or in the beginning of June, in the body of *Ph. sanguinea* are visible the larvae arranged along the axis of the body of the maternal individual; they perform characteristic wavy movements. Sometimes single larvae pierce the uterus and reach the body cavity of the nematode. At this stadium the

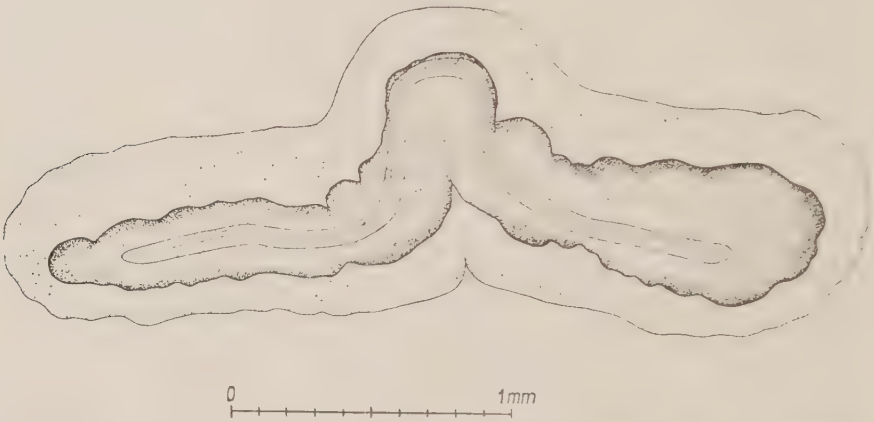


Fig. 2. Encysted *Philometra sanguinea* from the body cavity of crucian.

females leave the fins and pass into water. Owing to differences in the osmotic pressure, the pressure within the body of the parasite increases, what causes a discription of the nematode and a liberation of the larvae which pass into water.

In the course of dissections of fishes after the period of the fertilization of the nematodes I found only males, which remained in the same place, in the body cavity. They lived there for some time and it was not until the late autumn and in winter when I found them dead, encapsulated, surrounded with connective tissue (Fig. 2). In the course of the next several months they were resorbed by the organism of the host.

The described development of *Ph. sanguinea* indicates that there is a whole year lasting developmental cycle of this parasite under our climatic conditions. Experimental studies proved, however, that at a higher temperature of the environment this cycle may be shortened and at the temperature (during the whole period of development) between 15 — 22°C I attained complete development of the nematode in the course of six months.

Conclusions

Summing up the results of my work on *Philometra sanguinea* (R u d o l p h i, 1819) the following conclusions can be drawn:

(1) *Philometra sanguinea* has under our climatic conditions one developmental cycle in the course of one year which includes the period from June to May of the next year; this period under warmer conditions may be shortened. I succeeded to obtain this under laboratory conditions, conducting a complete developmental cycle of the nematode in the course of six months, from June till December.

(2) To the complete development of the nematode an intermediate host, a rapacious plankton *Crustacea*, suitably large, able to swallow the larva of the nematode, is necessary. To such belong the species of the genera *Cyclops, Mesocyclops* and *Macrocyclops*. Small rapacious plankton forms, and even lower copepodits of larger forms, are not able to eat the relatively too large for them larvae (0.37 — 0.45 mm in length) and therefore they are not invaded. Not rapacious forms of *Crustacea* become not invaded with the larvae of this nematode. It was also impossible to attain an invasion with *Ph. sanguinea* in higher *Crustacea*.

(3) The invaded crustacean is inhibited in its development by the larvae of nematode.

(4) The larva becomes invasive after about 4 days stay in the body of crustacean. The period of the invasiveness lasts from six to ten days.

(5) Under natúral conditions I found the invasiveness of *Ph. sanguinea* only towards *Carassius carassius* (L.).

(6) *Ph. sanguinea* is dangerous to small fishes which are not able to endure the migration of the females from the body cavity to the fins. The smallest crucian, in which a mature female of the nematode was found in the fin, measured 9.4 cm. In the lake Track I observed a strong decrease of the number of young crucians caused most likely by the invasion with *Ph. sanguinea*. I observed here also an increase of the number of *Perca fluviatilis* L., which could also contribute towards the decrease of the numerosity of young crucians. This is, however, contradicted by the large number of *Leucaspius delineatus* (H e c k e l) present in this lake, which is the basic nourishment of *Perca fluviatilis* L.

(7) In spite of numerous attempts I did not succeed to discover the way and mode of the migration (active or passive of the females of *Ph. sanguinea* from the body cavity to the fins, and this problem will be the subject of my further studies on this species of parasite.

Author's address:
Zakład Chorób Ryb W. S. R.
Olsztyn — Kortowo

LITERATURE

1. Baylis H. A., Daubney R. — A synopsis of the families and genera of nematoda. London, 1926.
2. Baryšjeva A. F., Bauer O. N. — Parazity ryb Ladožskogo ozera. Izvestia WNIORCH, 42, 1957.
3. Linstow O. — Parasitische Nematoden. In: Brauer — Die Süsswasserfauna Deutschlands, 15, 1909.
4. Čákay — Nalez *Philometra sanguinea* (Rudolphi, 1919) na Slovensku. Biológia, 12, 12, 1957.
5. Kaštak V. — Výsledku parazitologického prieskumu plotic (*Rutilus rutilus*) teplého ramena Váhu u Pieštan. Vet. Časopis, 5, 2, 1956.
6. Kozicka J. — Pasożyty i stan zdrowotny leszcza (*Abramis brama* L.) w Wiśle koło Warszawy. Rocz. Nauk Rolniczych, 58, 1951.

6a. Kozicka I. — Parasites of fishes of Drużno Lake. Acta Parasit. Polon., 7, 1, 1959.

7. Laiman E. M. — Bolezni ryb. Moskva, 1957.
8. Maksimova A. P. — Parazitofauna jazia vodoemov Centralnego Kazakstana. Trudy Inst. Zool. AN. Kazakskoi SSR, 7, 1957.
9. Markevič A. P. — Parazitofauna presnovodnych ryb USSR. Kiev, 1951.
10. Nybelin O. — Rudolphi's „*Filaria sanguinea*" wiedergefunden. Archiv för Zoologi, 19 B, 8, 1928.
11. Nybelin O. — Zur Entwicklungsgeschichte von „*Filaria*" *sanguinea* Rudolphi nebst Bemerkungen über verwandte Arten, insbesondere über den Medinawurm. 121, Jena, 1931.
12. Palli M. A. — Parazit ščuki *Philometra (Filaria) obturans* Prenant. Zool. Žurnal, 37, 4, 1954.
13. Schäperclaus W. — Fischkrankheiten. Berlin, 1954.
14. Skrjabin K. I. — Opredelitel parazitičeskich nematod, 4, Moskva, 1954.
15. Wierzbicki K. — Filometroza karasia (*Philometrosis carassii*). Wiad. Parazytologiczne, 4, 5/6, 1958.
16. Yamaguti S. — 19. Studies on the Helminth Fauna of Japan, Part 33, Nematodes of Fishes II. Jap. Journ. Zool., 9, 3, 1941.

STRESZCZENIE

Ogółem zbadano 510 karasi, pochodzących głównie z jezior Track i Skrwilno; 208 karasi było zarażonych nicieniem *Philometra sanguinea* (R u d.), co stanowi 41%. U innych ryb nie stwierdzono zarażenia tym nicieniem. Poza tym przeprowadzono doświadczalne zarażenie 57 ryb larwami *Ph. sanguinea* w akwariach i stwierdzono inwazję w wysokości 75%.

Ph. sanguinea ma w naszych warunkach klimatycznych jeden cykl rozwojowy w ciągu roku, zamykający się w okresie od czerwca do maja roku następnego; okres ten w warunkach cieplejszych może ulec skróceniu. Udało się to uzyskać w warunkach laboratoryjnych, przeprowadzając pełny cykl rozwojowy nicienia w okresie sześciu miesięcy, od czerwca do grudnia.

Do pełnego rozwoju nicienia potrzebny jest żywiciel pośredni, drapieżny skorupiak planktonowy, odpowiednio duży, aby mógł połknąć larwę nicienia. Należy tu gatunki z rodzajów *Cyclops, Mesocyclops* i *Macrocyclops*. Formy planktonowe drapieżne małe, a nawet niższe kopepodity form większych, nie zjadają stosunkowo zbyt dużych dla nich larw (0,37 — 0,45 mm długości) i nie zarażają się. Nie zarażają się również larwami tego nicienia skorupiaki niedrapieżne oraz skorupiaki wyższe.

Larwa staje się inwazyjna po około czterech dniach przebywania w ciele skorupiaka. Okres inwazyjności trwa przez sześć do dziesięciu dni.

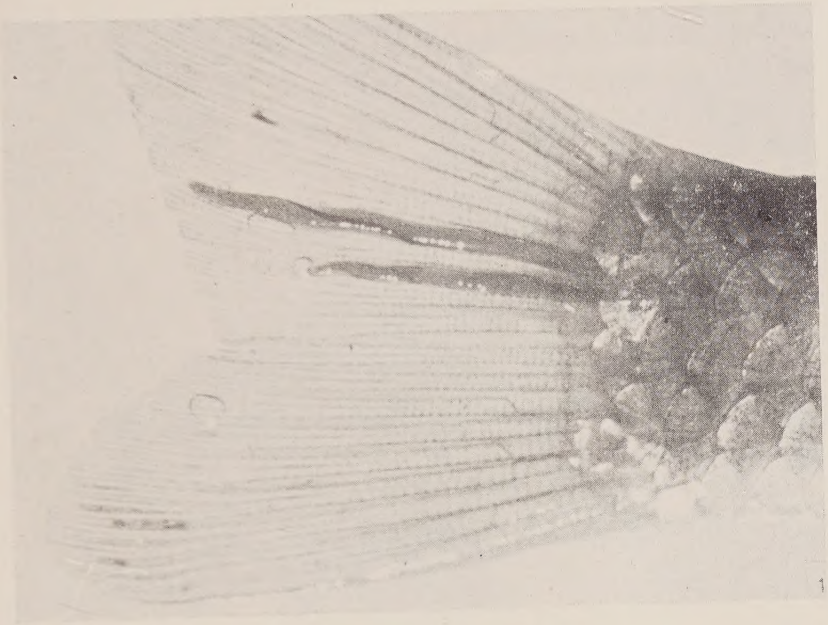
Ph. sanguinea jest groźny dla małych ryb, które nie wytrzymują wędrówki jego samic z jamy ciała do płetw. W jeziorze Track zaobserwowano silne zmniejszenie się ilości drobnego karpia spowodowane prawdopodobnie inwazją *Ph. sanguinea*.

PLATE I

Phot. 1. *Philometra sanguina* (R u d.) in caudal fin of crucian (Phot. W. Strojny).

Phot. 2. Larvae of *Ph. sanguinea* in the body cavity of *Cyclops kolensis* L i l l j. (Phot. E. Kalamarz).

Phot. 3. Transversal section of the fin of crucian invaded with *Ph. sanguinea* (Phot. auctor).


1

2

3

K. Wierzbicki